Treatment Options for PFAS at a Surface Water Treatment Plant

Carel Vandermeyden, P.E.

Director of Engineering

Cape Fear Public Utility Authority

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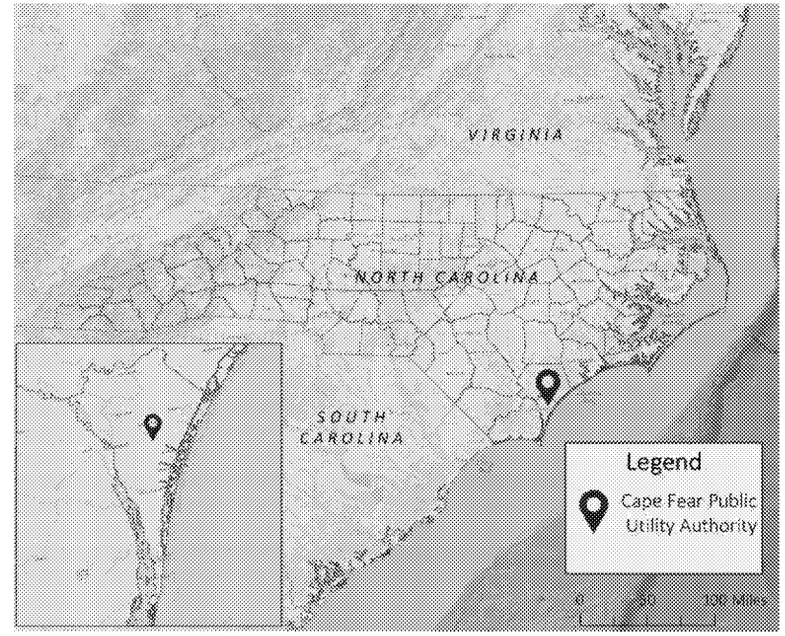
- Located in Wilmington, North Carolina
- 200,000 customers
- Two groundwater systems (7 mgd)
- One surface water system (35 mgd) - Cape Fear River raw water supply
- Per- and Polyfluorinated compounds (PFAS) detected in source and drinking water, including GenX



Existing Sweeney Water Treatment Plant

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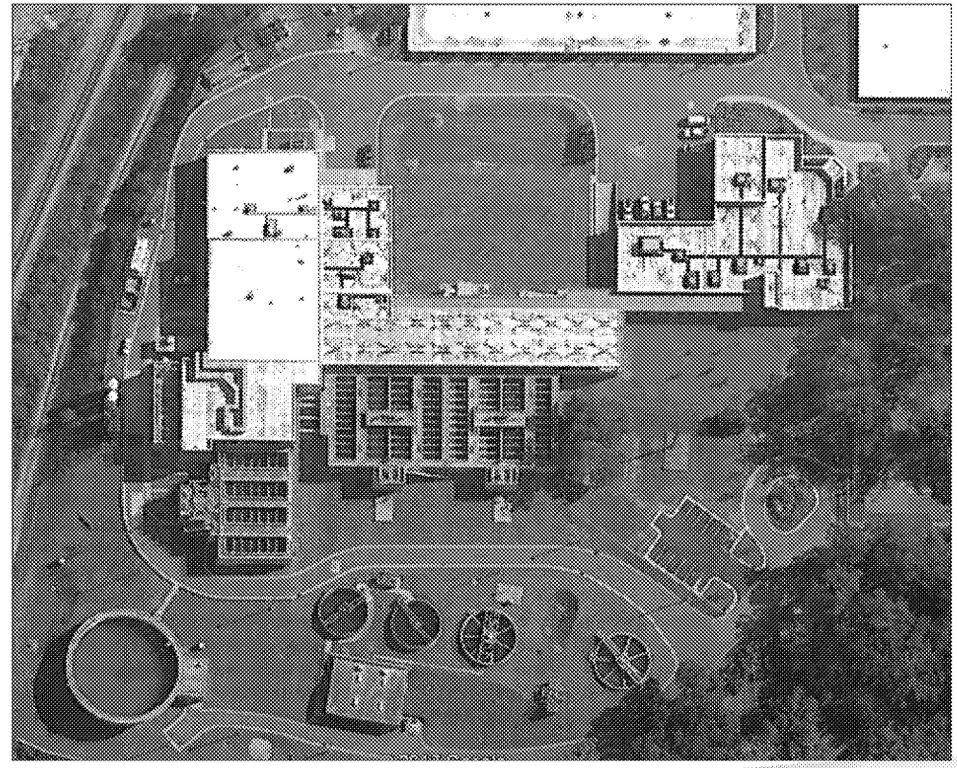
- Conventional treatment
- Raw water ozonation
- Pre-filter ozonation
- Biofiltration with GAC
- UV
- Chlorine disinfection
- More advanced treatment methods required for PFAS



Per-Fluorinated Compounds in the Cape Fear River

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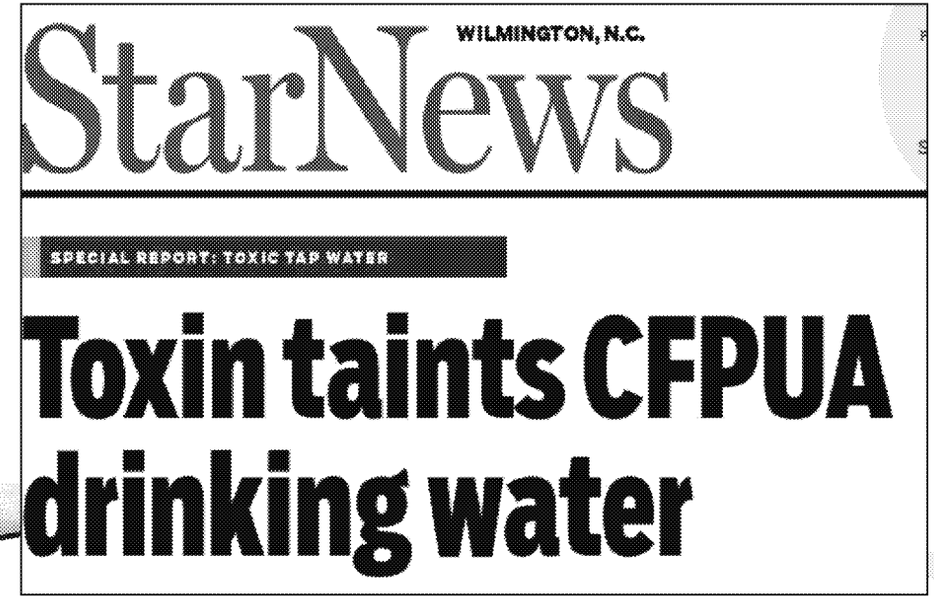
- June 2017 - *Wilmington StarNews* article on the presence of GenX in the Cape Fear River and in CFPUA drinking water.
- GenX is only about 12% of all PFCs quantified in source water.
- No MCL for GenX or other PFAS.
- NC-DHHS issued a preliminary health advisory level of 140 ppt for GenX.
- Customer Concerns:
  - Thousands of calls from concerned customers.
  - Numerous public forums, media interviews. Weekly press releases by CFPUA.
  - 9,800 people are members of the on-line "North Carolina Stop GenX in our Water" community organizing group.
  - Awareness of emerging contaminants has decreased consumer confidence in drinking water.
  - Utilities (ratepayers) should not bear the cost to address source water contamination by others.


WILMINGTON, N.C.

StarNews

SPECIAL REPORT: TOXIC TAP WATER

Toxin taints CFPUA drinking water

CFPUA Action on PFAS — 14 Months

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- For over one year, we have worked on the issue of GenX and other PFAS compounds.
- We have:
  - Worked with UNCW to identify new compounds.
  - Worked with NCDEQ to remain informed on regulatory actions.
  - Worked with NCDHHS to understand the health impacts.
  - Continuously monitored levels of PFAS in drinking water.
  - Taken legal action against Chemours.
  - Set up free water stations in our groundwater areas.
  - Conducted a full pilot study to investigate treatment options.
  - Removed 50 million gallons from the Aquifer Storage and Recovery site.
  - Participated in interviews, forums and industry conferences to share our experience with regulators, utilities and the public.

Testing for PFAS in CFPUA Service Areas

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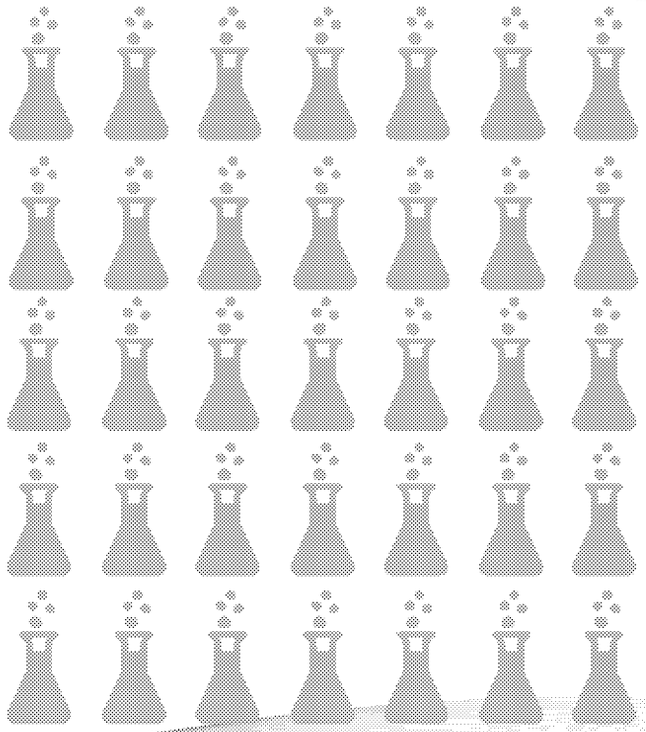


CFPUA regularly monitors for 45 different PFAS

8 PFAS do not have testing standards and results must be estimated

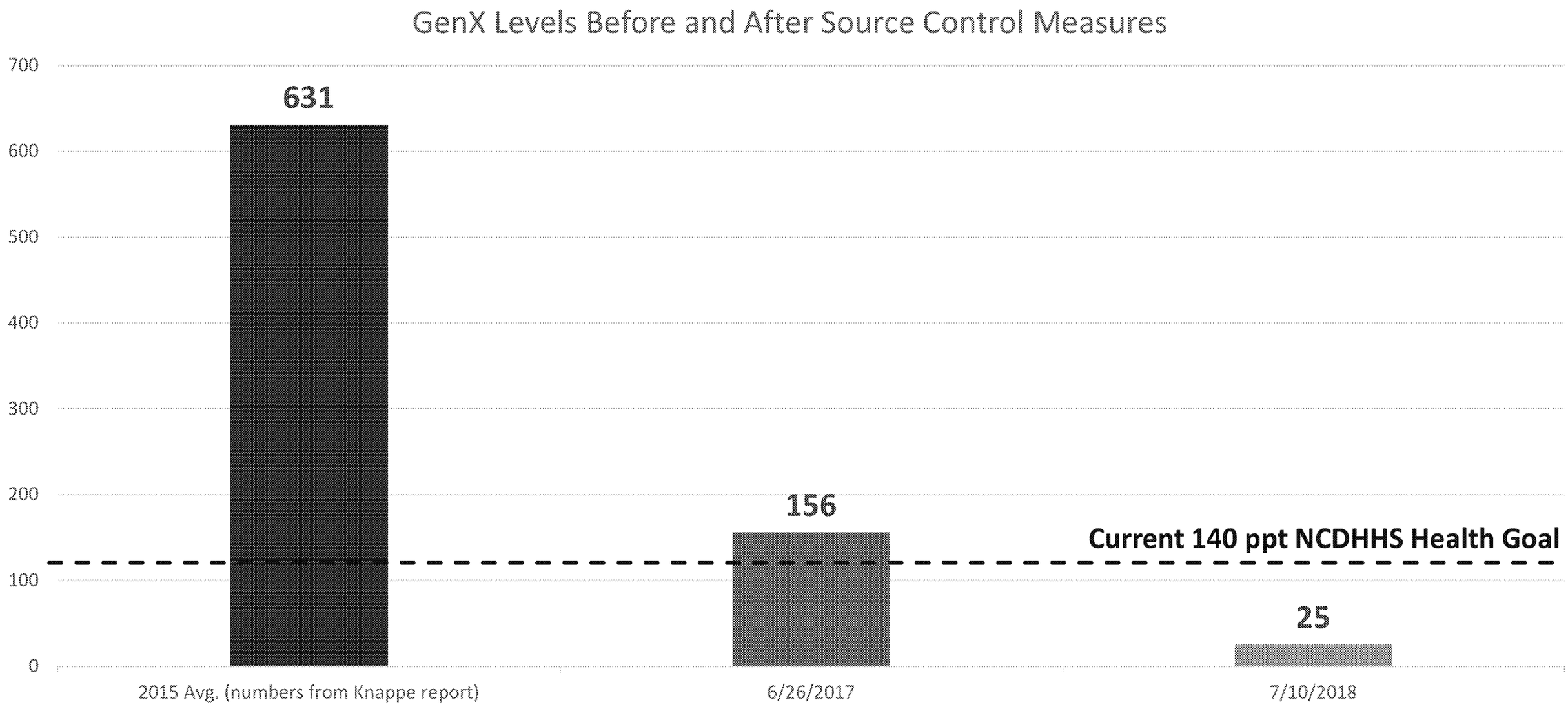
37 PFAS have testing standards

Of the **37** PFAS that have testing standards,

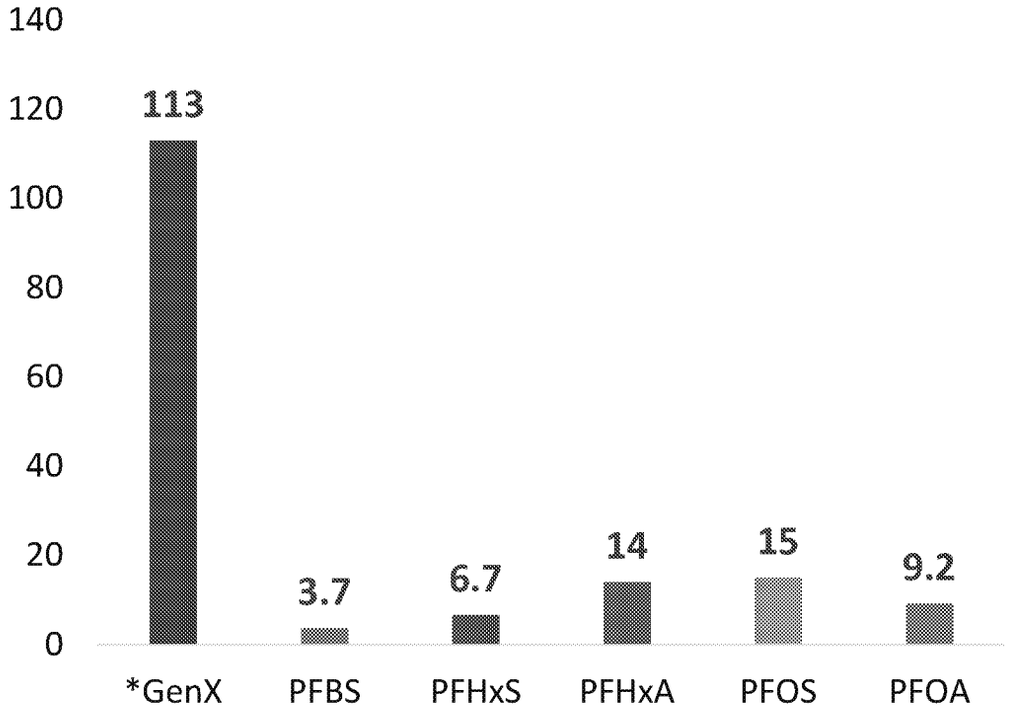
27 are typically at non-detectable limits and

10 are consistently detected

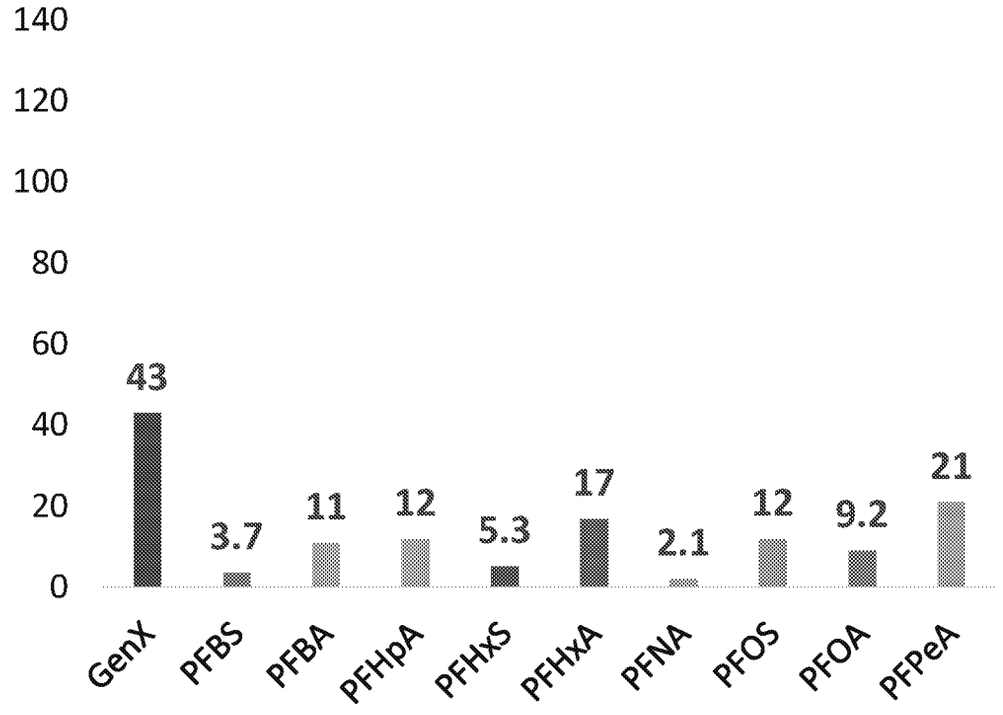
Source Control Shows Success with GenX



GenX Levels are Down, Other PFAS Remain: Is Remediation Needed?



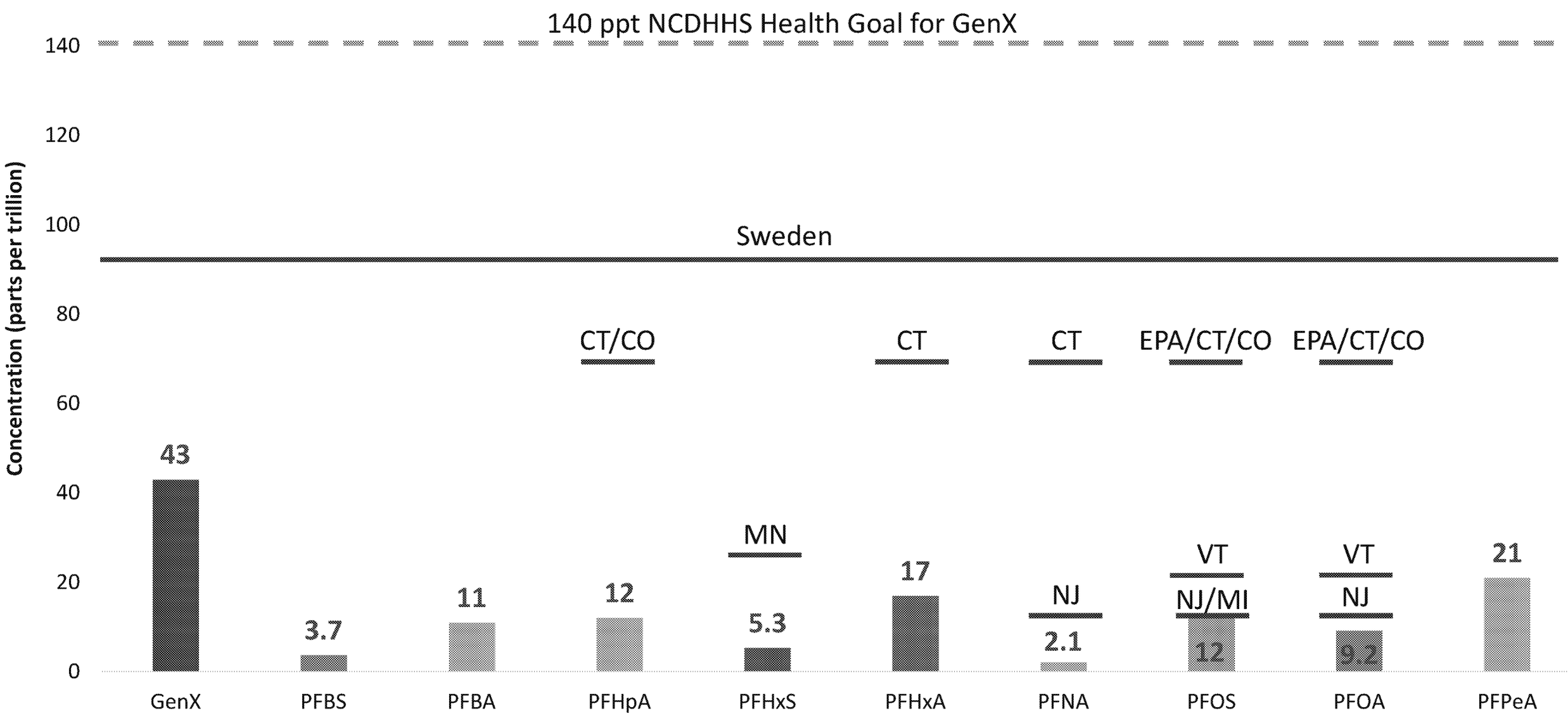
July 2017



June 2018

*Levels of compounds are measured in parts per trillion (ppt)

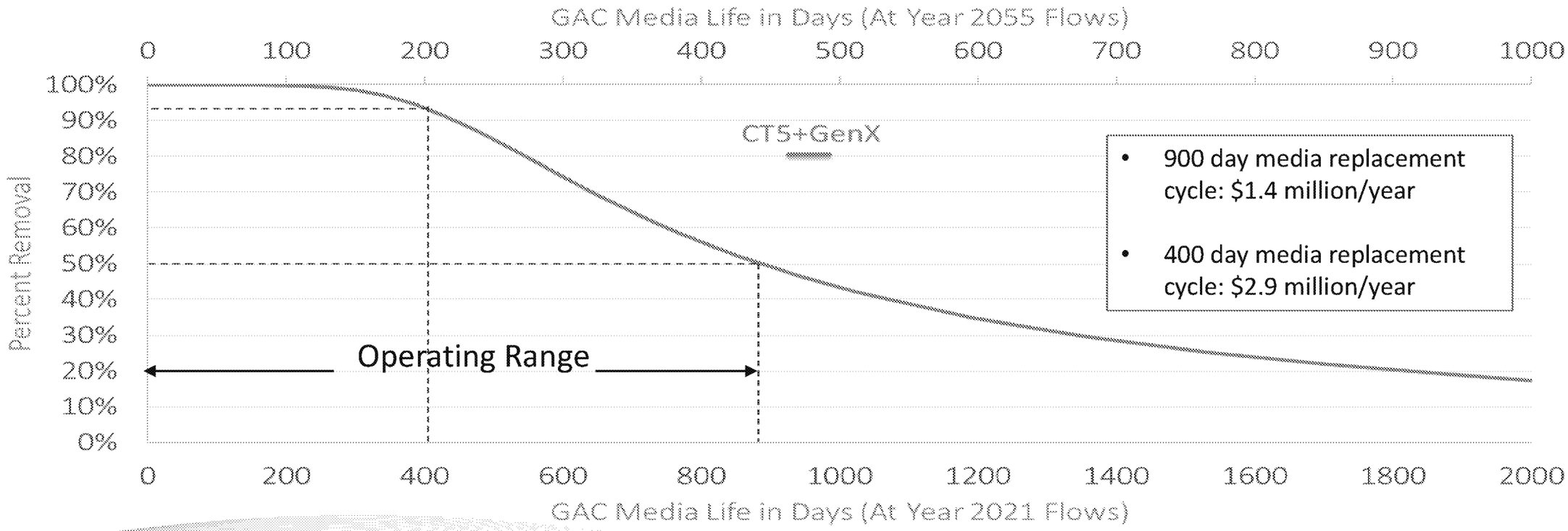
What Are the Existing Health Goals for PFAS?



Completed Pilot Testing to Select PFAS Treatment Options

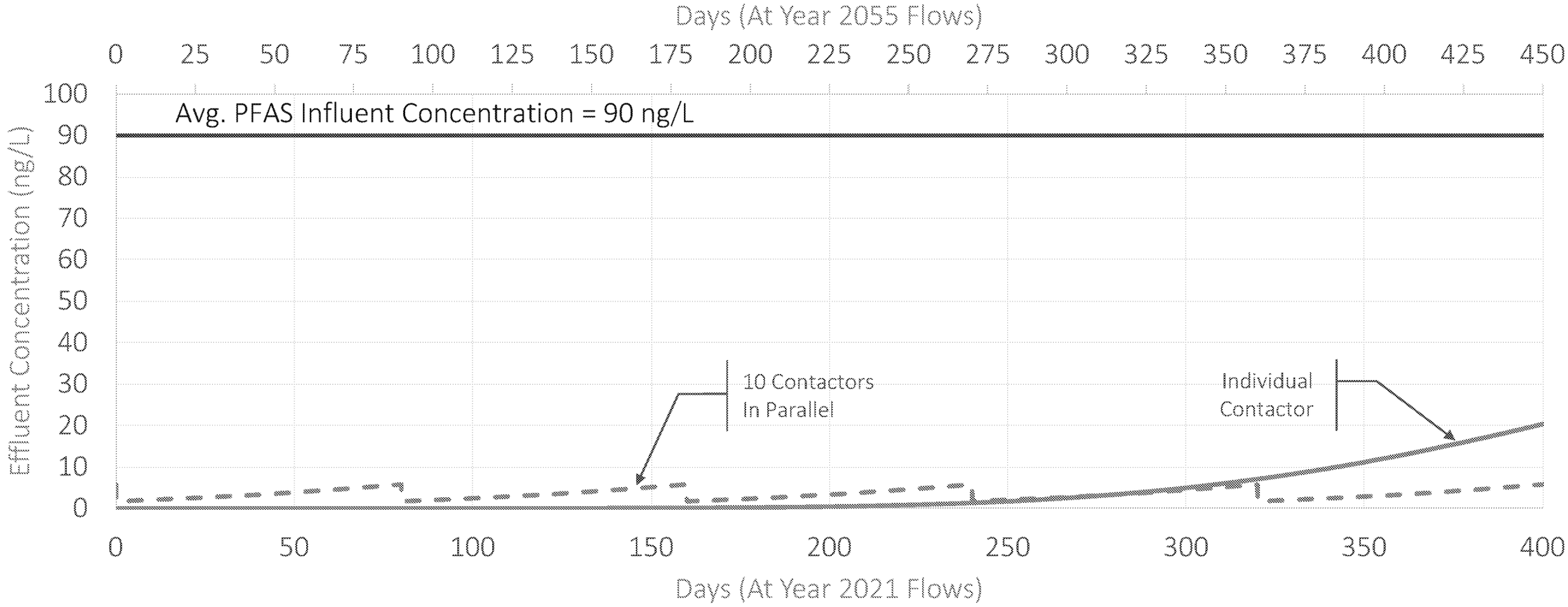
- Technologies Considered
  - Granular Activated Carbon
  - Ion Exchange
  - Reverse Osmosis
- Operational Strategies
- Criteria for Full Scale Design
- Considerations
  - Removal Rates
  - Environmental Impacts
  - Rate Impacts and Cost
- Secondary benefits if implemented for PFAS treatment

Life of GAC Media: When Do GenX and the "Connecticut Five" PFAS Begin to Breakthrough?

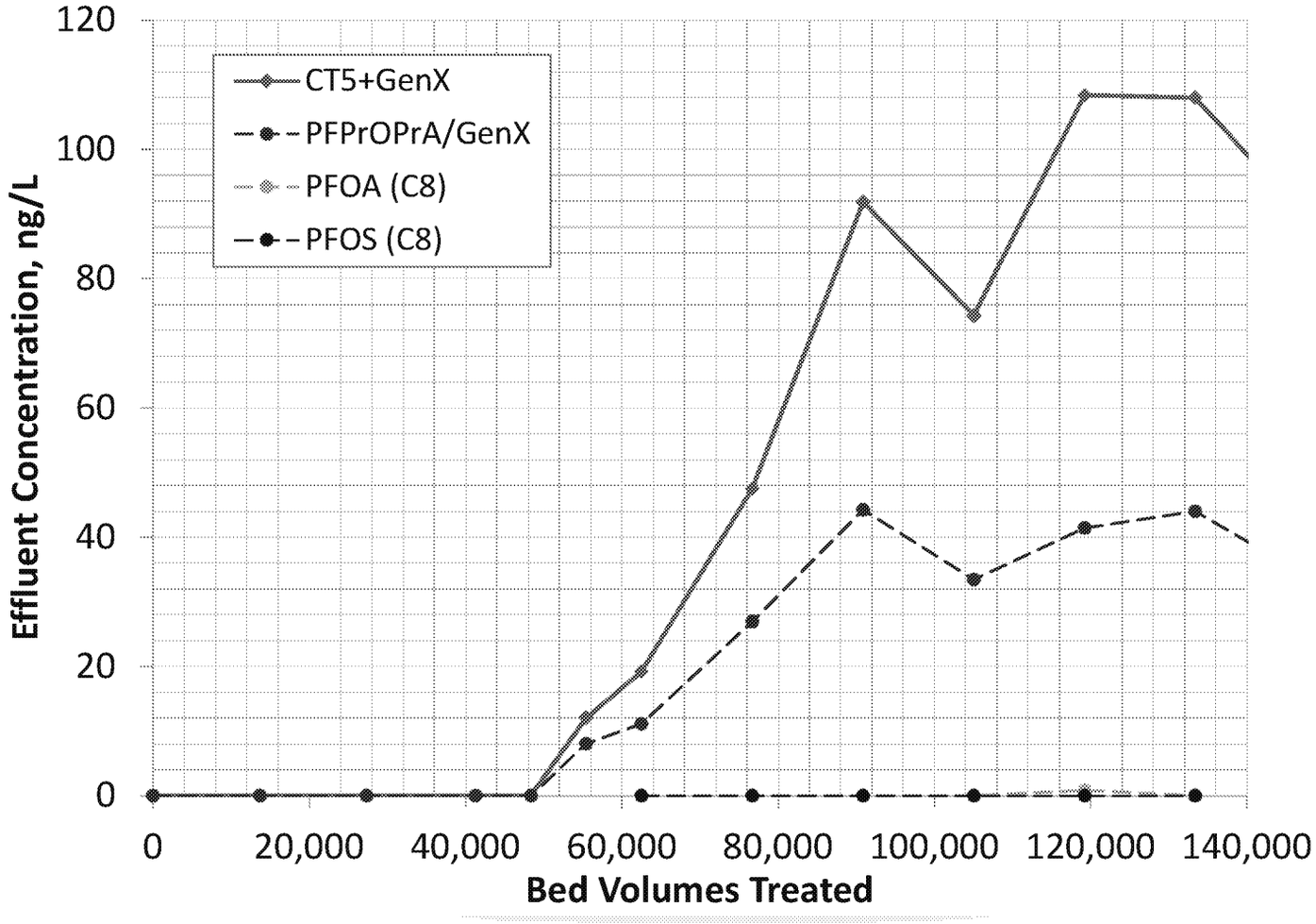


- 900 day media replacement cycle: $1.4 million/year
- 400 day media replacement cycle: $2.9 million/year

GAC Replacement Cycle at 400 Days Runtime



IX Performance



GAC is still the best treatment solution for the Sweeney WTP AND allows for transition to IX to address possible more stringent limits in the future.

Considerations for Selecting Treatment Process

Consideration	Granular Activated Carbon	Ion Exchange	Reverse Osmosis
Treatment			
• PFAS removal	Effective towards PFAS reduction	Effective towards PFAS reduction	Provides broad removal of all varieties of PFAS
• Flexibility	Can be modified to adapt to changes in regulations	Limited flexibility.	Limited flexibility because RO provides broad removal
• Corrosion control	Consistent with existing corrosion control program	Consistent with existing corrosion control program	Requires additional treatment to prevent lead and copper corrosion
Environmental	Removes PFAS from the environment	Filter media must be disposed of, cannot be destructed like carbon	Creates waste stream with concentrated PFAS levels to Cape Fear River (NPDES Permit required)

Financial Comparison to Reduce PFAS at the Sweeney Water Treatment Plant

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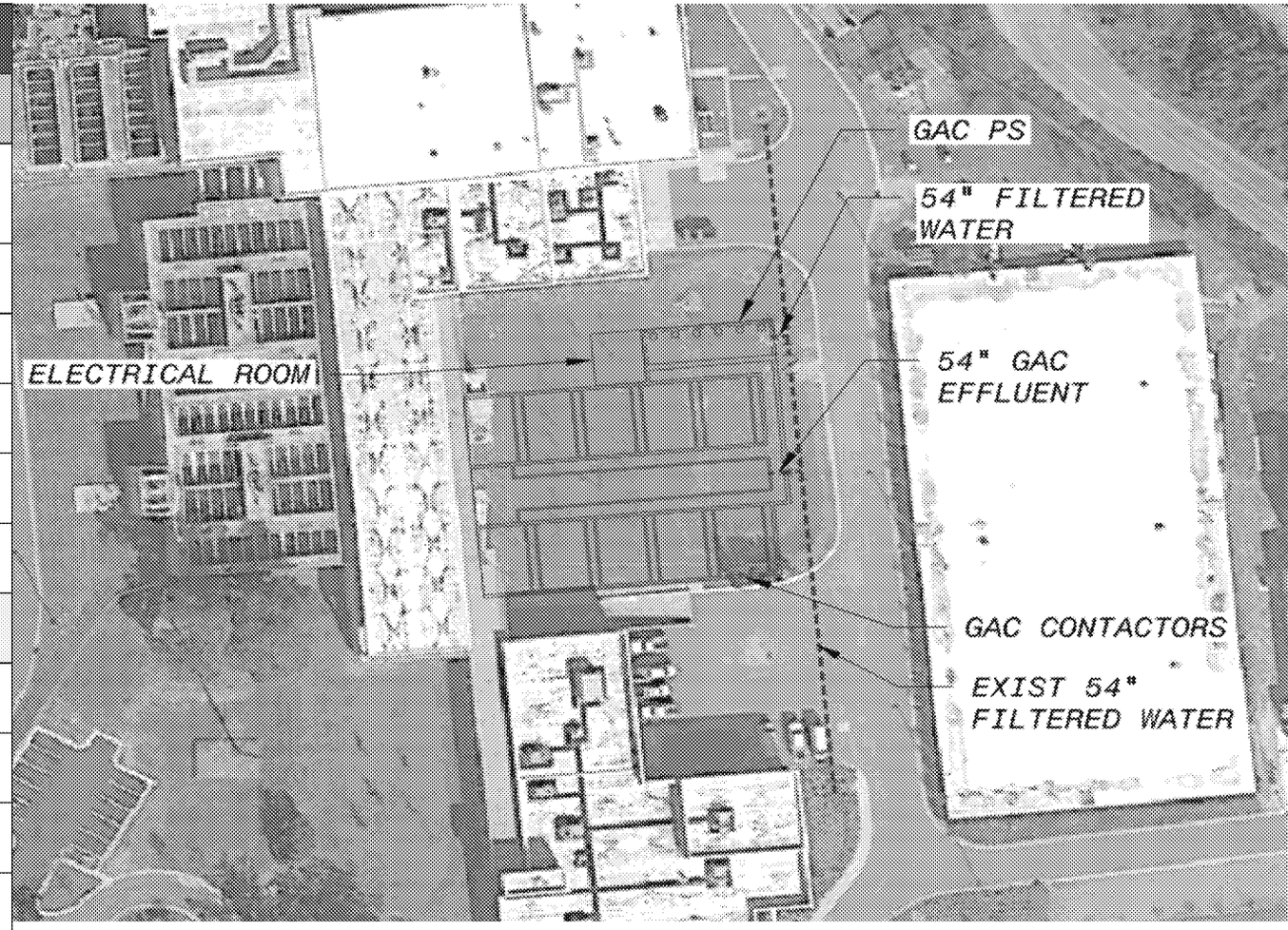
	GAC	RO
Capital Costs	$46,000,000	$150,000,000
Annual Operating Costs	$2,900,000	$4,700,000
Lifecycle Net Present Value	$215,000,000	$504,000,000

Conceptual GAC Facility

Deep Bed GAC Contactors Design Summary	
Contactors	
Quantity	10
Design Flow Rate, gpm (ea)	3,056
Type	Concrete Basin
Length (ea), ft	22
Width (ea), ft	37.6
Area (ea), sf	827
Media, per contactor	
Bed Depth, ft	10
Max Loading Rate, gpm/ft2	4.1
EBCT, min	20
Bed Volume, cf (ea)	8,272

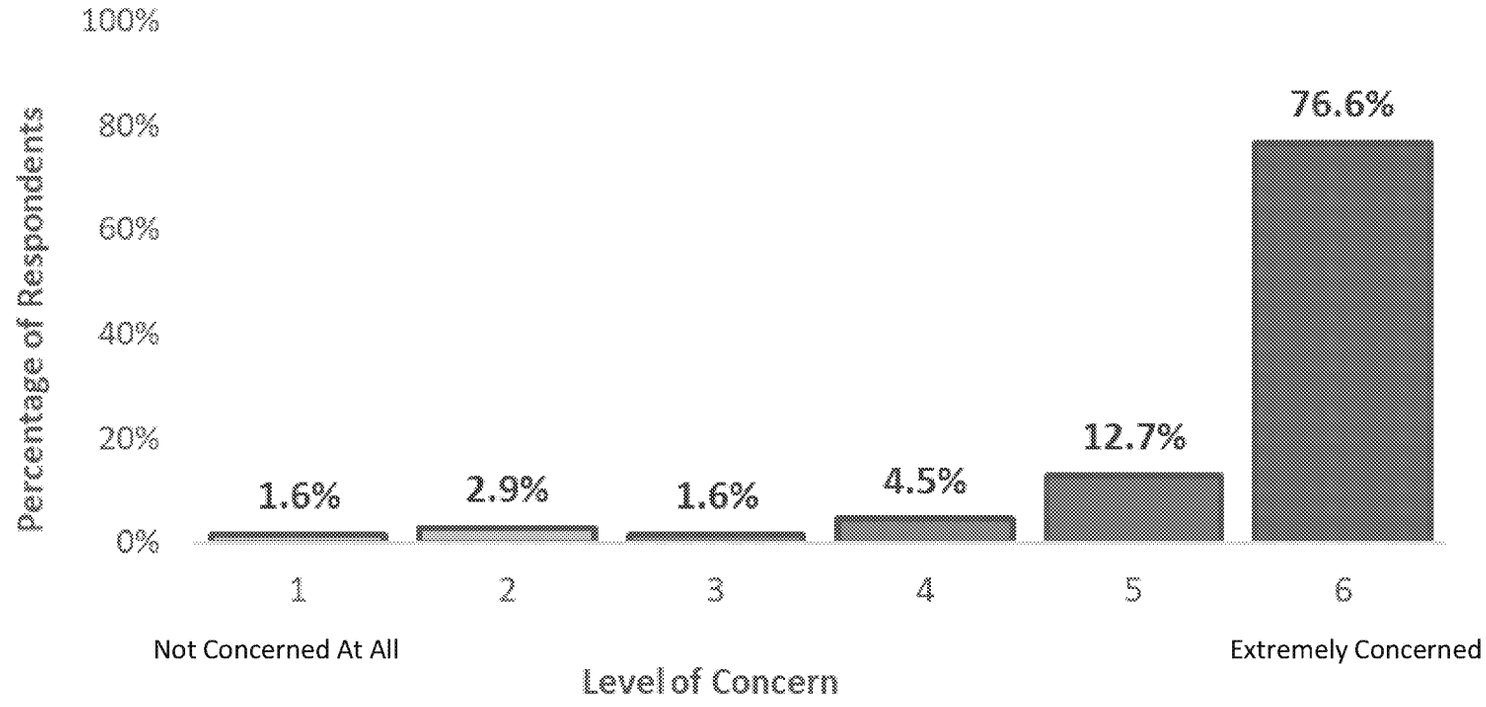


Customer Survey: Significant Trends

Question 4:

On a scale of one to six, rate your level of concern about GenX.

- 89.3% of respondents are concerned or extremely concerned about GenX.

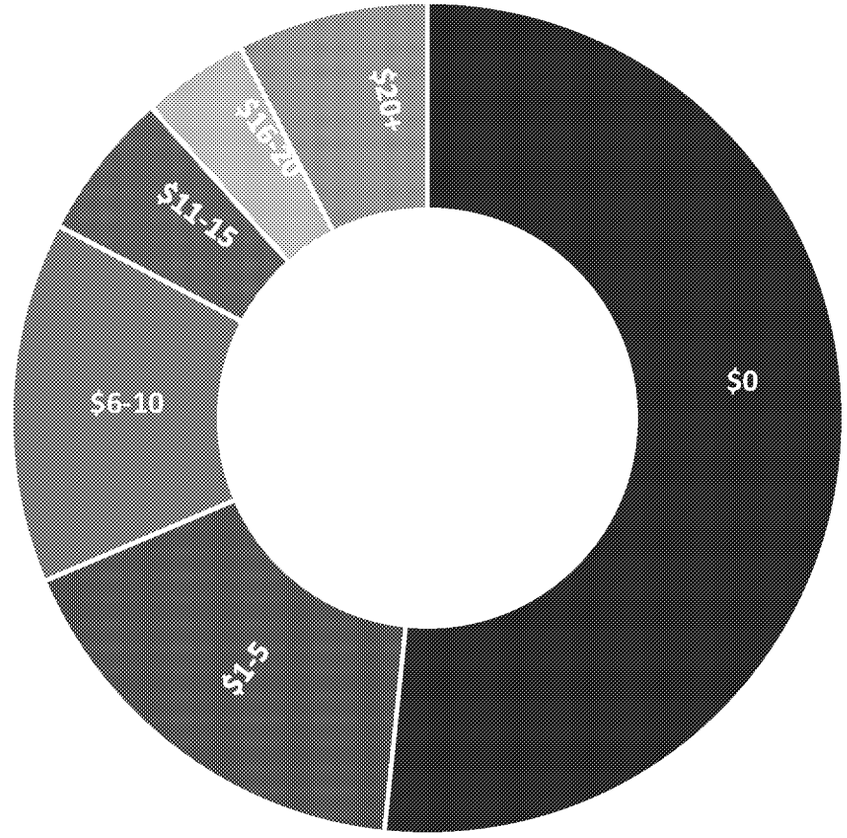


Customer Survey: Significant Trends

Question 6:

Select the most (per bimonthly bill) that you are willing to pay in addition to your current charges for the CFPUA plant upgrade.

- Of customers that responded "$0":
  - 83% responded that they were extremely concerned about GenX.
  - Many believe Chemours should be the organization that pays for an upgrade.
- 48.45% of respondents were willing to pay between $1-$20+ per bi-monthly bill for a Sweeney upgrade.



Customer Survey: What Are We Doing Well?

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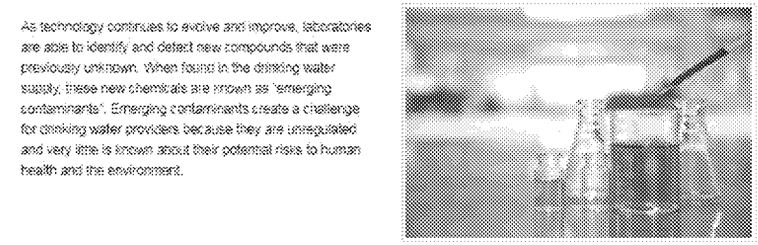
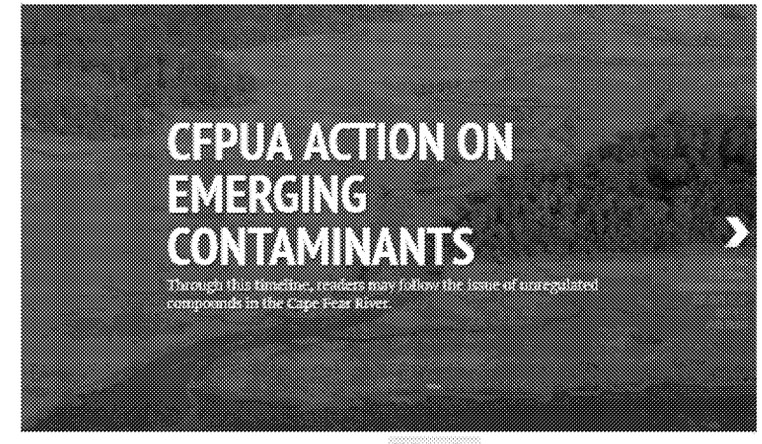
- **CFPUA website was listed as a popular source of information on this issue.**
  - Staff should continue to use the website, social media and our Notify Me! Program to release regular and accessible information to customers and the media regarding PFAS compounds and other water quality issues.

- **Customers overwhelmingly agree with our decision to take legal action.**
  - CFPUA should continue to update the public, when possible, on our litigation against Chemours





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Questions?